# Climate impacts in the PAGE09 model

Prepared for the
Climate Damages Workshop
Washington DC
18 – 19 November 2010
By

Dr Chris Hope
Judge Business School
University of Cambridge
c.hope@jbs.cam.ac.uk

SEI

ClimateCost

CAMBRIDGE
Judge Business School

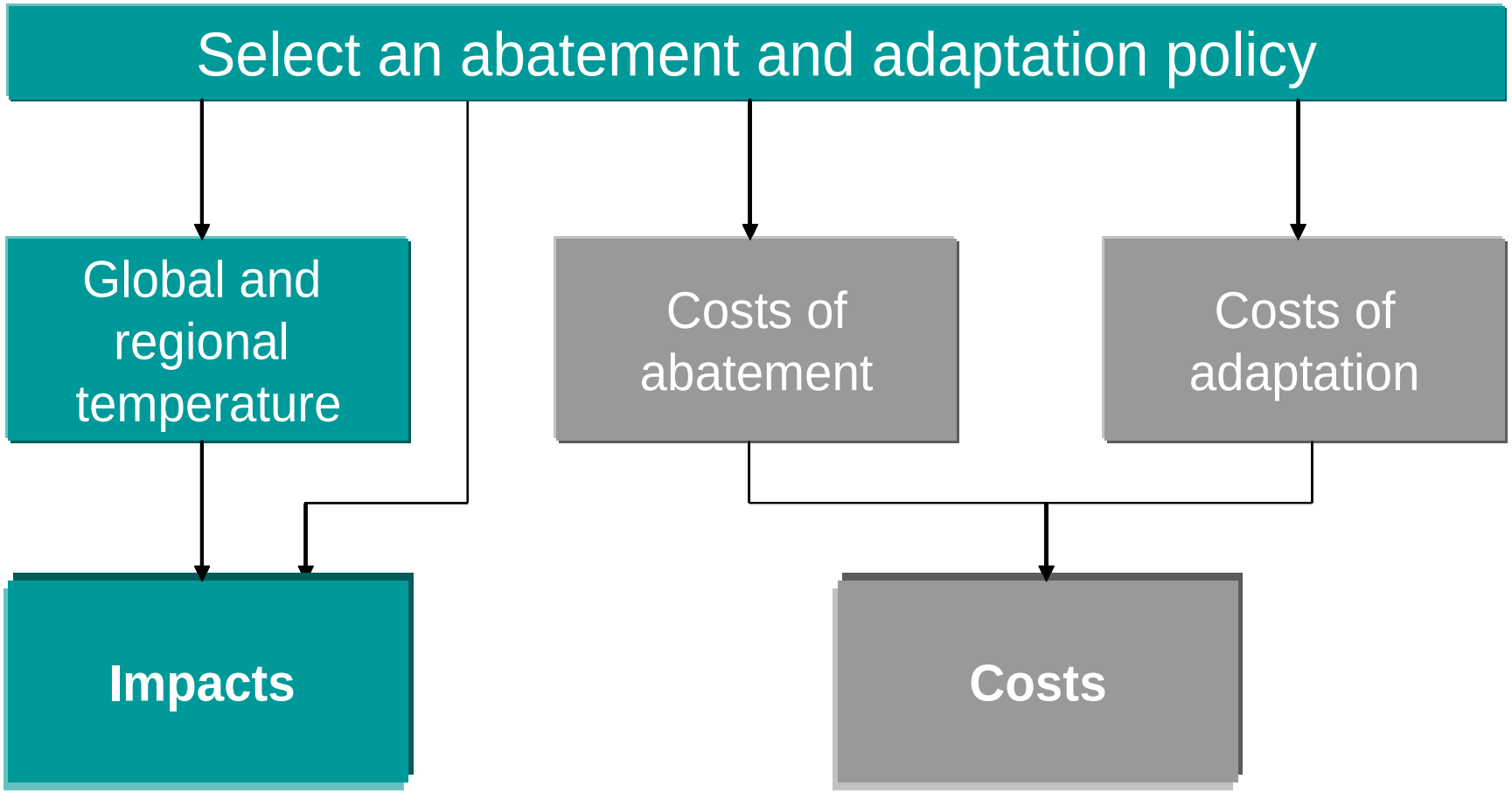
# Plan of talk

- The PAGE09 model.
- Impacts and the social cost of CO2.
- Comparison with results from PAGE2002

# The PAGE09 model

- A development of the PAGE2002 model
- Excel 2007 worksheet with @RISK 5.5 add-in
- 4 greenhouse gases
- 8 regions
- 10 analysis years
- 3 impact sectors and discontinuities
- 2 policies and their difference
- 10000 runs to calculate probability distributions of outputs

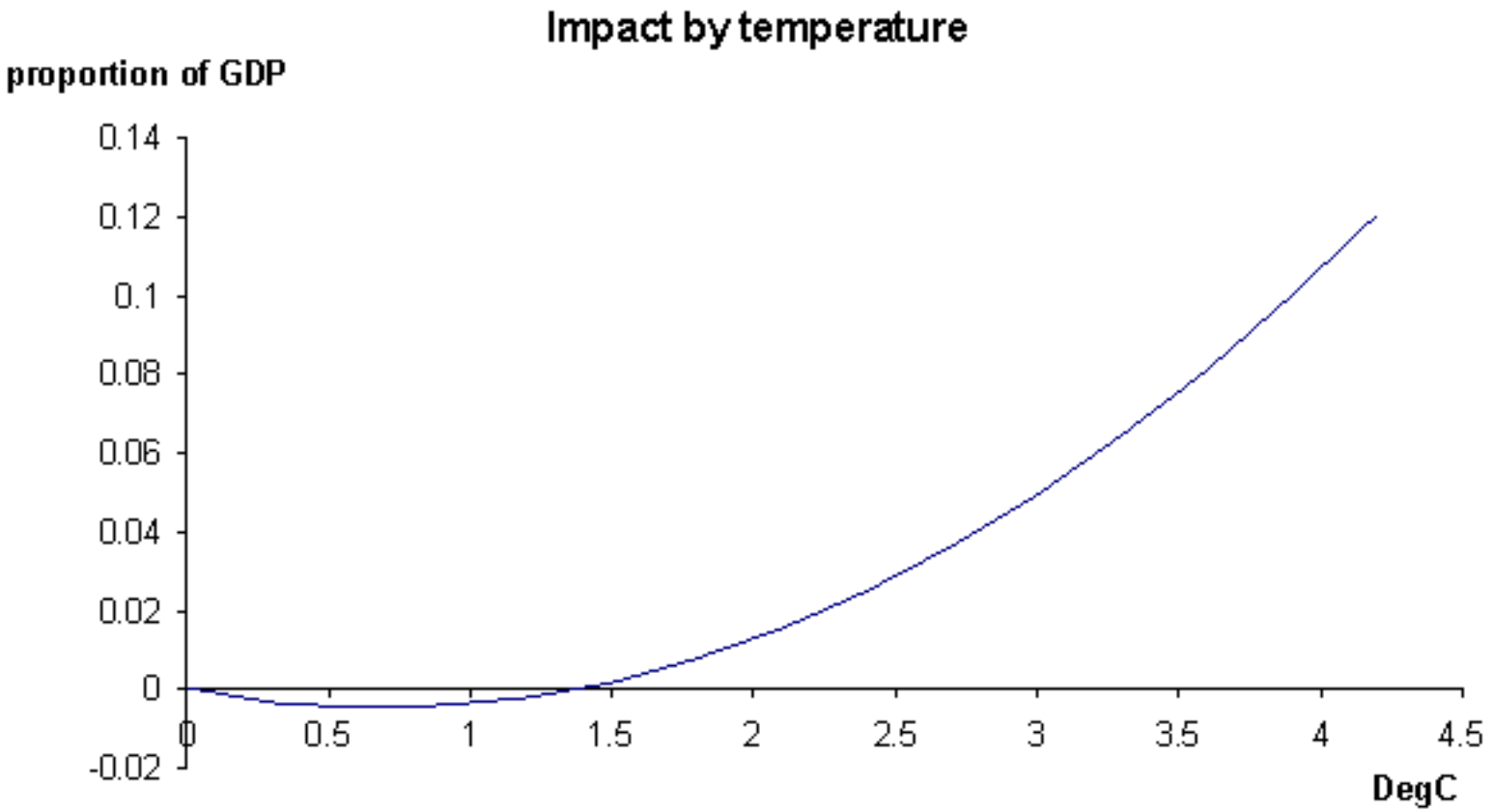
# Structure of the PAGE09 model




SEI ClimateCost CAMBRIDGE Judge Business School

# New features of PAGE09

# Possibility of benefits

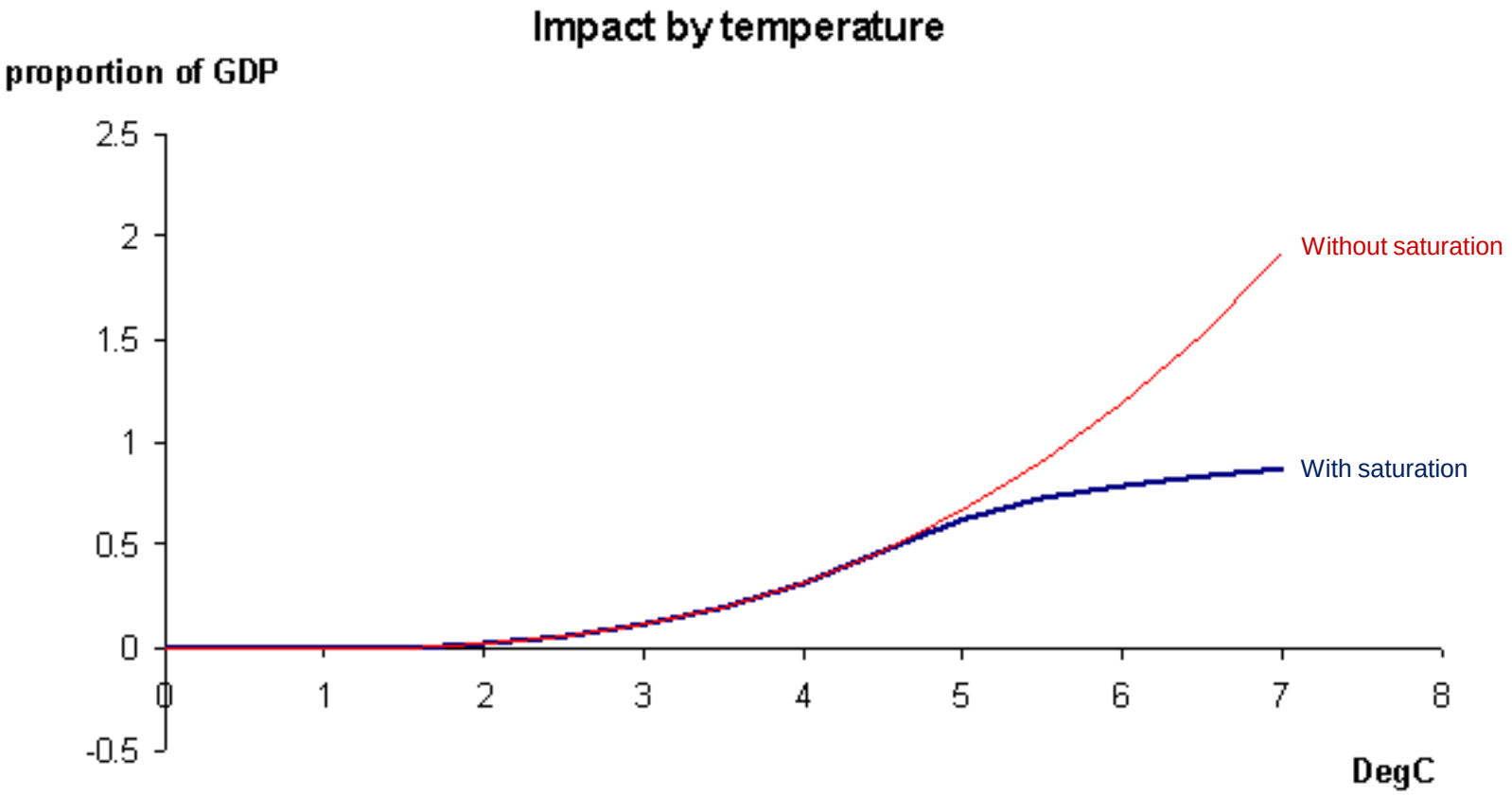



SEI

ClimateCost

CAMBRIDGE
Judge Business School

# Saturation of impacts

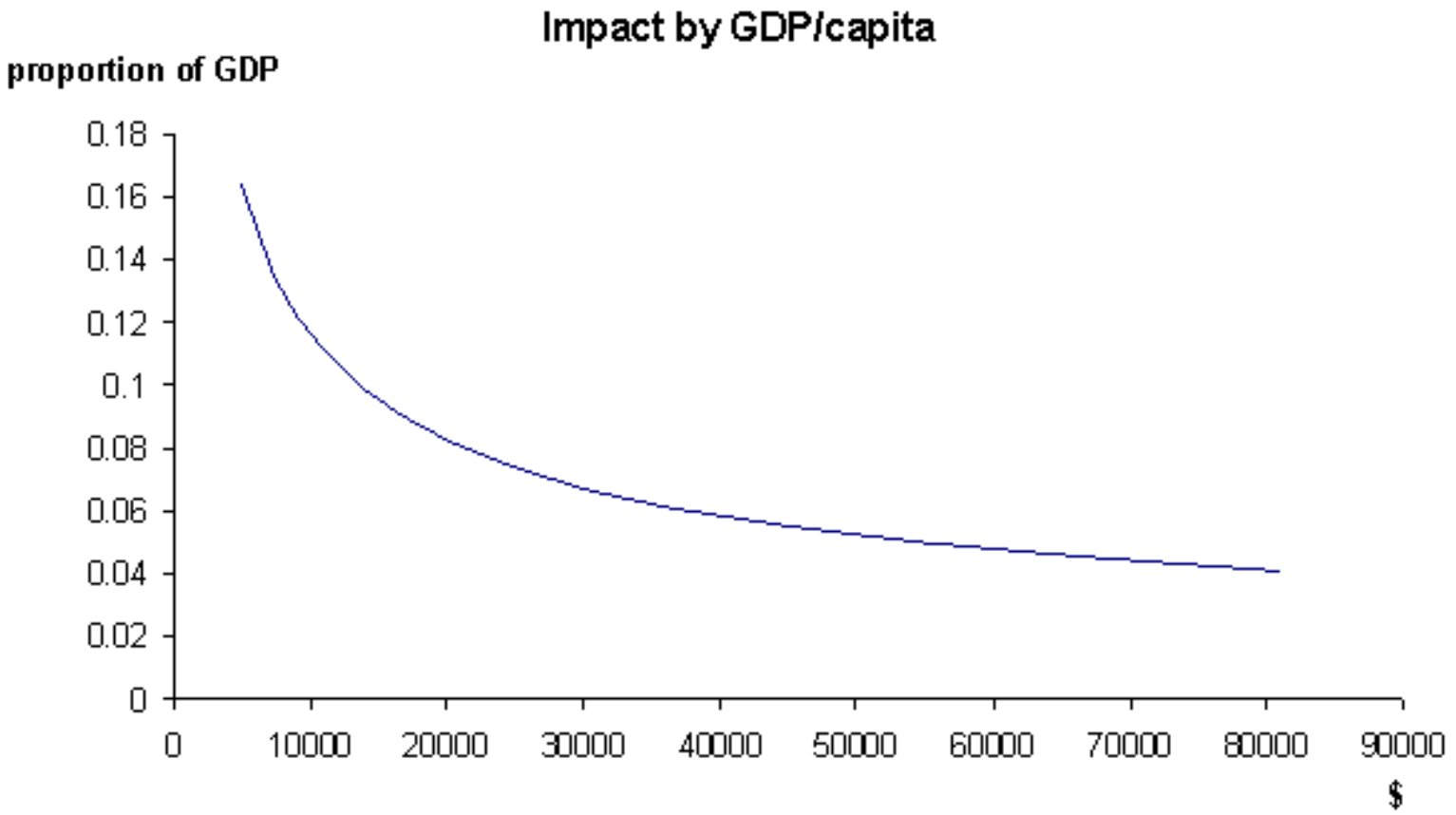



SEI

ClimateCost

CAMBRIDGE
Judge Business School

# Impacts as a function of GDP/capita




SEI

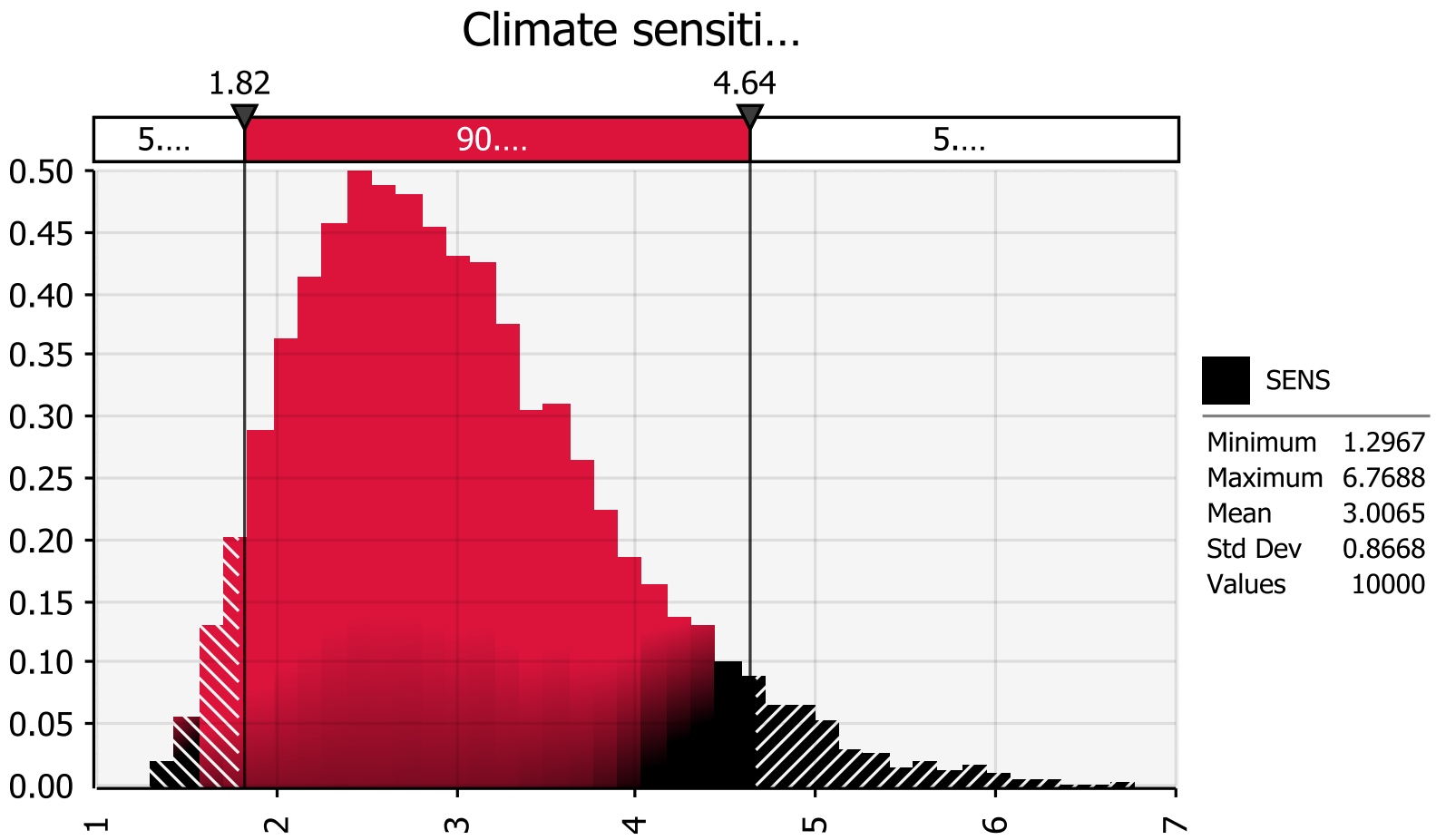
ClimateCost

CAMBRIDGE
Judge Business School

# Impacts and $SCCO_2$

- Business as usual scenario: A1B.
- Low emissions scenario: 2016 r5 low.
- Moderate adaptation.
- Currency unit: $2005, PPP exchange rates, EU base year GDP/cap.
- Pure time preference rate: <0.1,1,2> % per year.
- EMUC: <0.5,1,2>.

SEI ClimateCost CAMBRIDGE Judge Business School

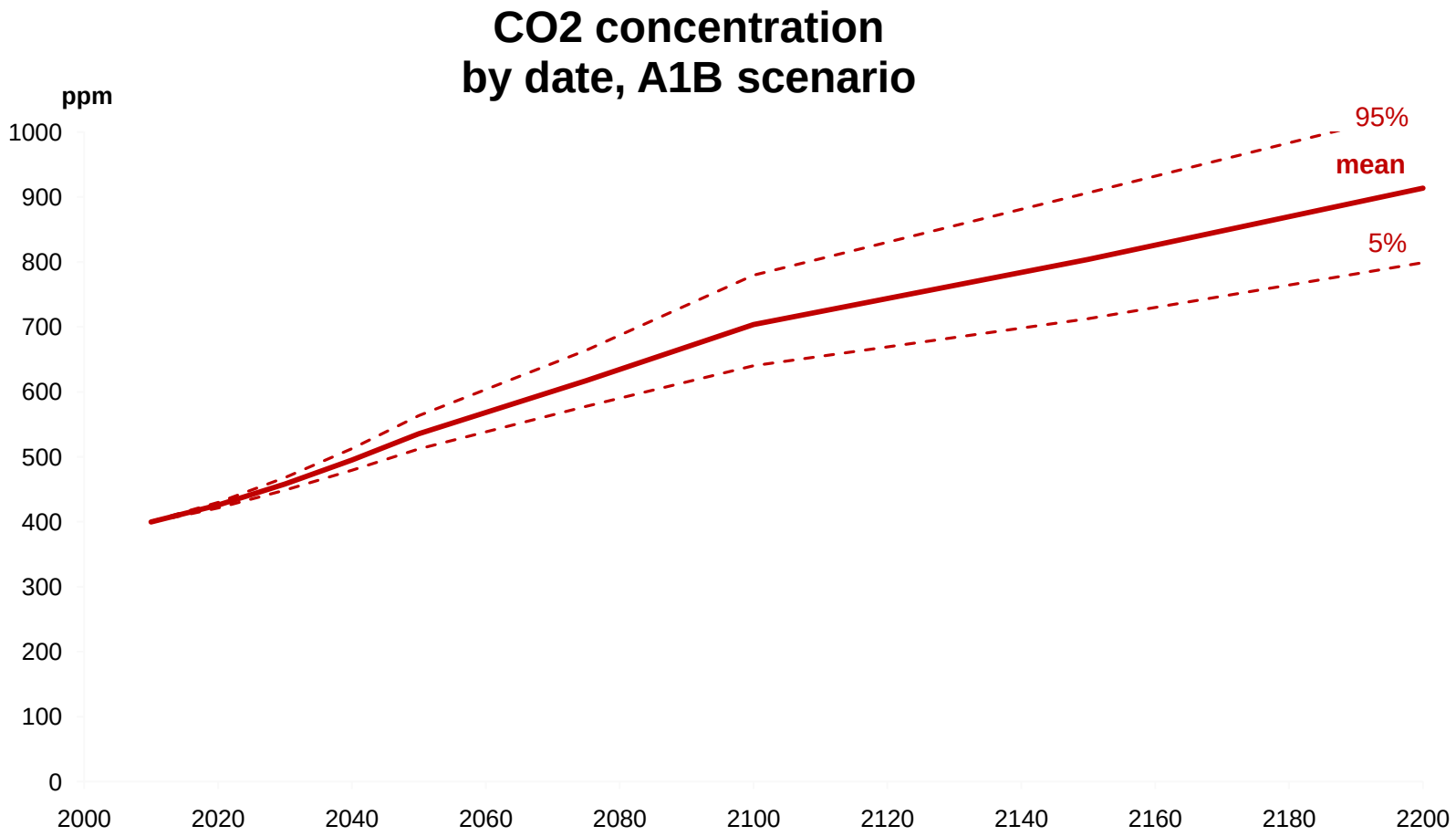



Source: 10000 PAGE09 runs

SEI

ClimateCost

CAMBRIDGE Judge Business School



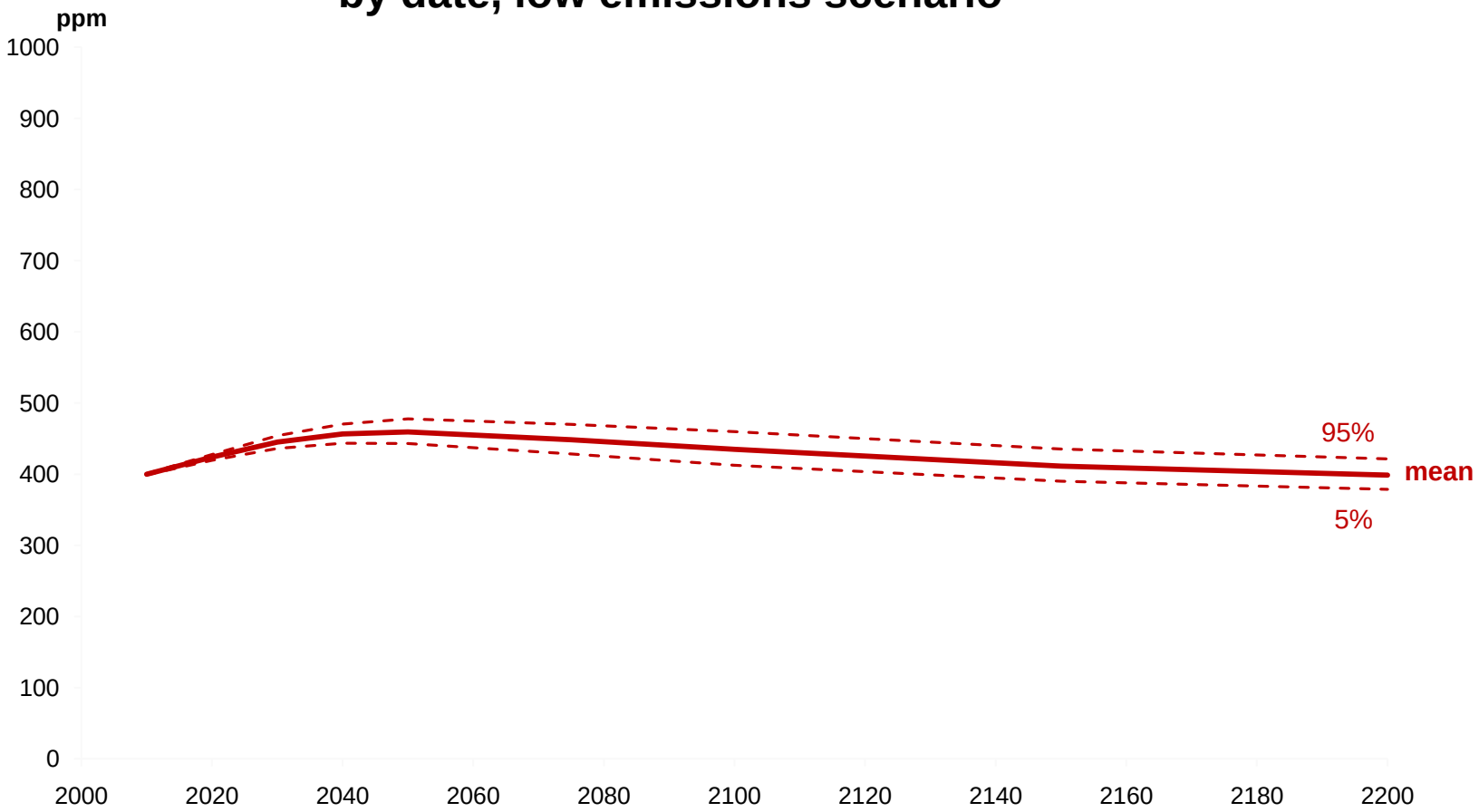

Source: 10000 PAGE09 runs

SEI

ClimateCost

CAMBRIDGE
Judge Business School

# CO2 concentration by date, low emissions scenario



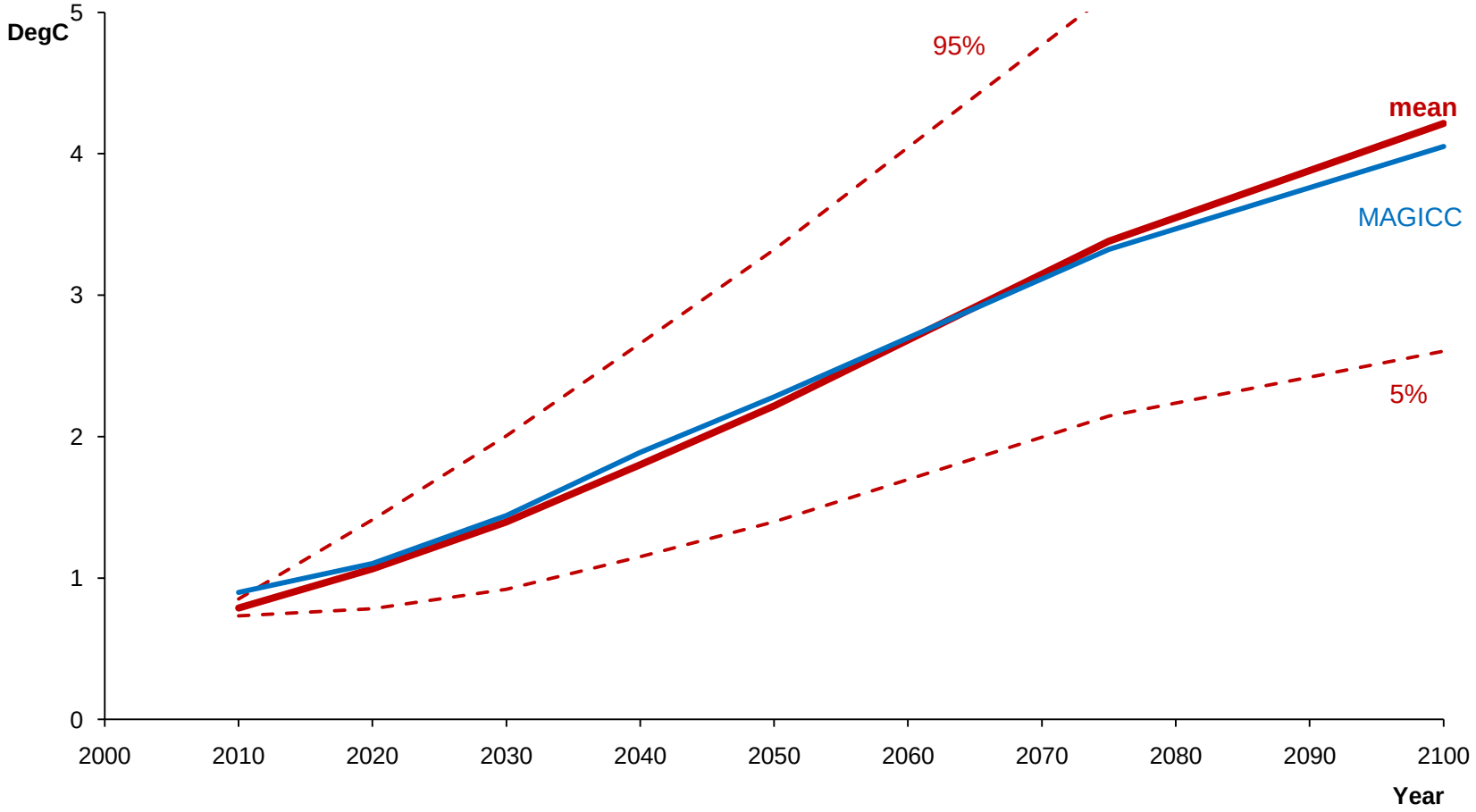

Source: 10000 PAGE09 runs

SEI

ClimateCost

CAMBRIDGE Judge Business School

# Global mean temperature rise by date, A1B scenario



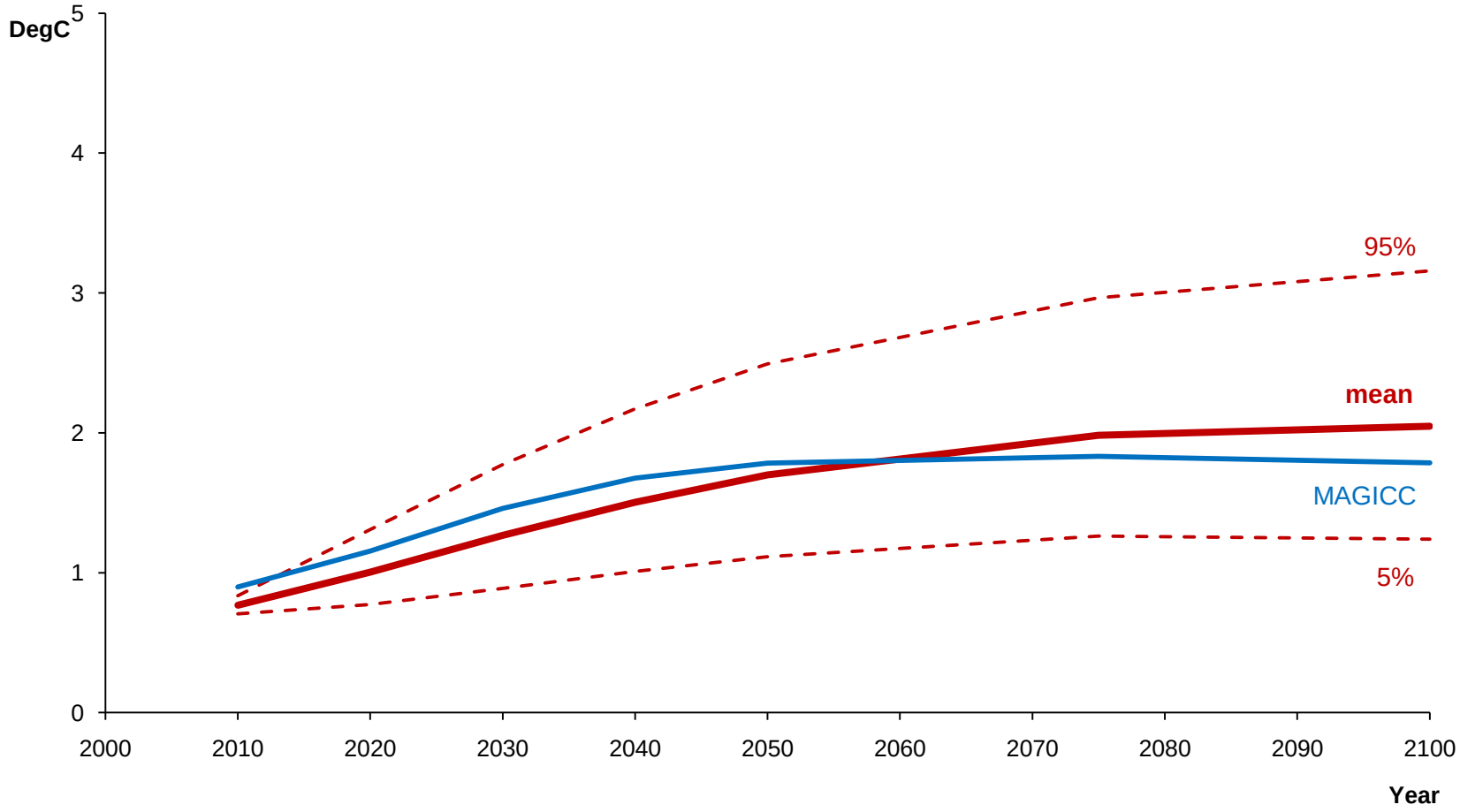

Source: 10000 PAGE09 runs

SEI

ClimateCost

CAMBRIDGE Judge Business School

# Global mean temperature rise by date, low emissions scenario



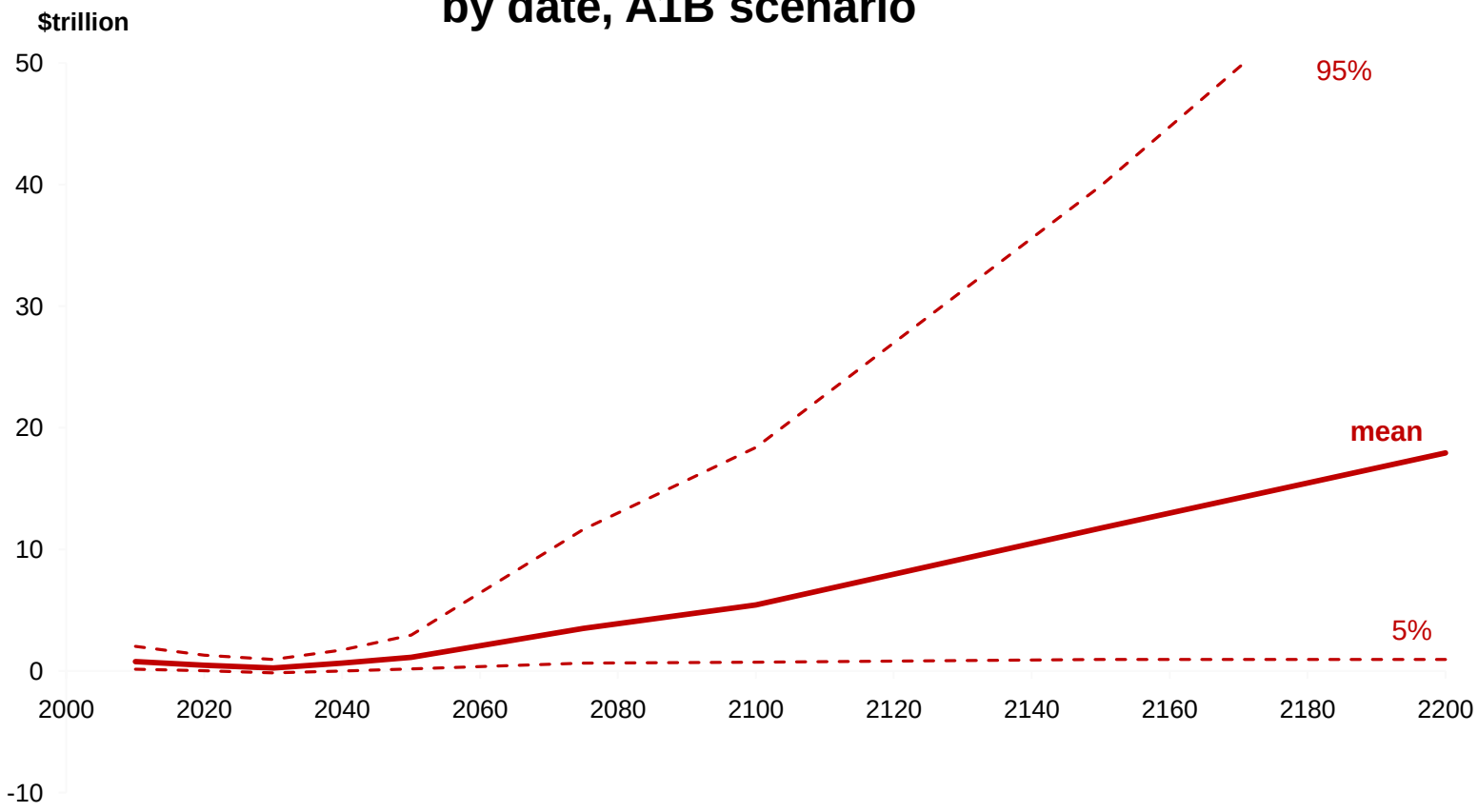

Source: 10000 PAGE09 runs

SEI

ClimateCost

CAMBRIDGE Judge Business School

# Global impacts by date, A1B scenario



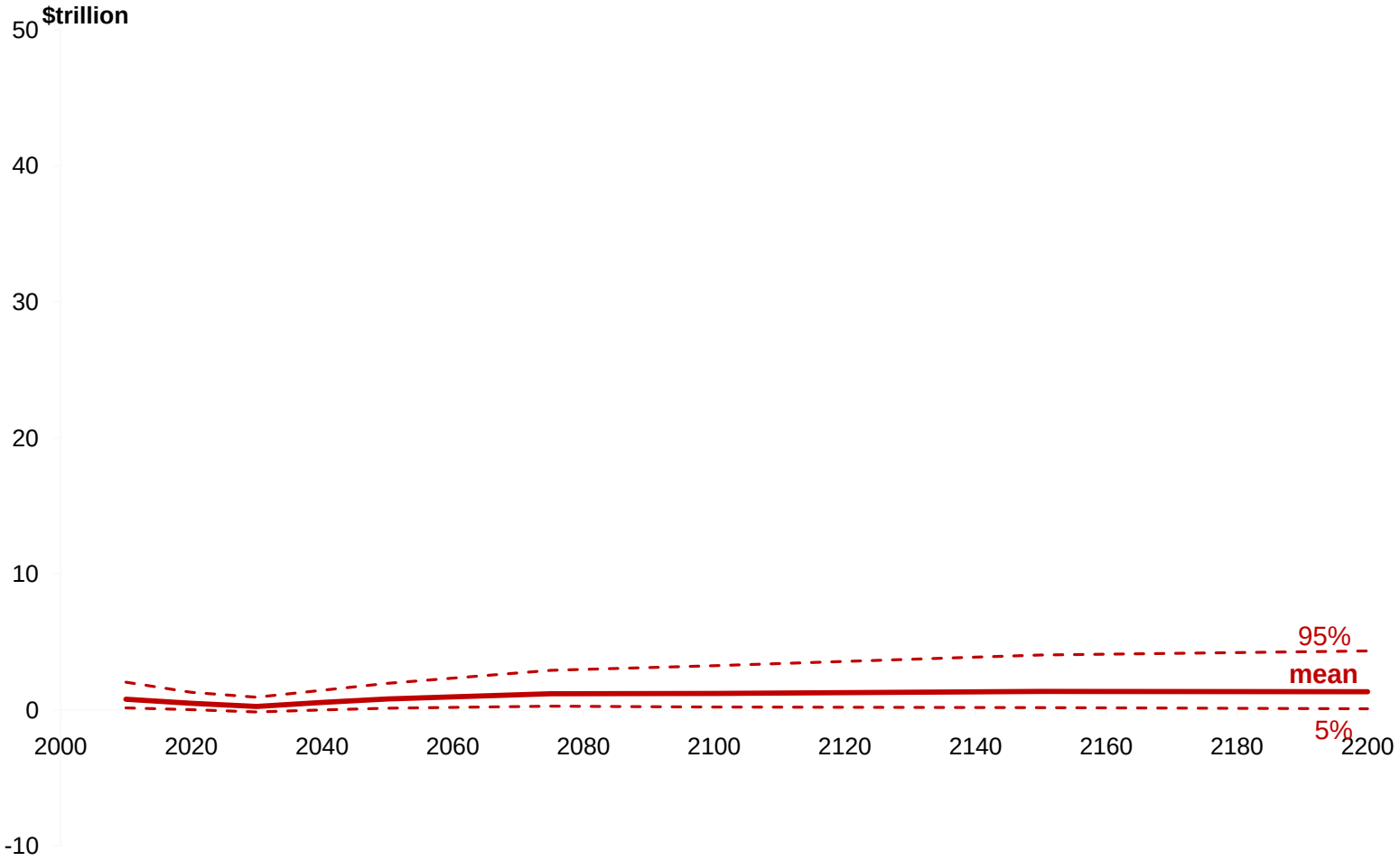

Source: 10000 PAGE09 runs

SEI

ClimateCost

CAMBRIDGE Judge Business School

# Global impacts by date, low emissions scenario

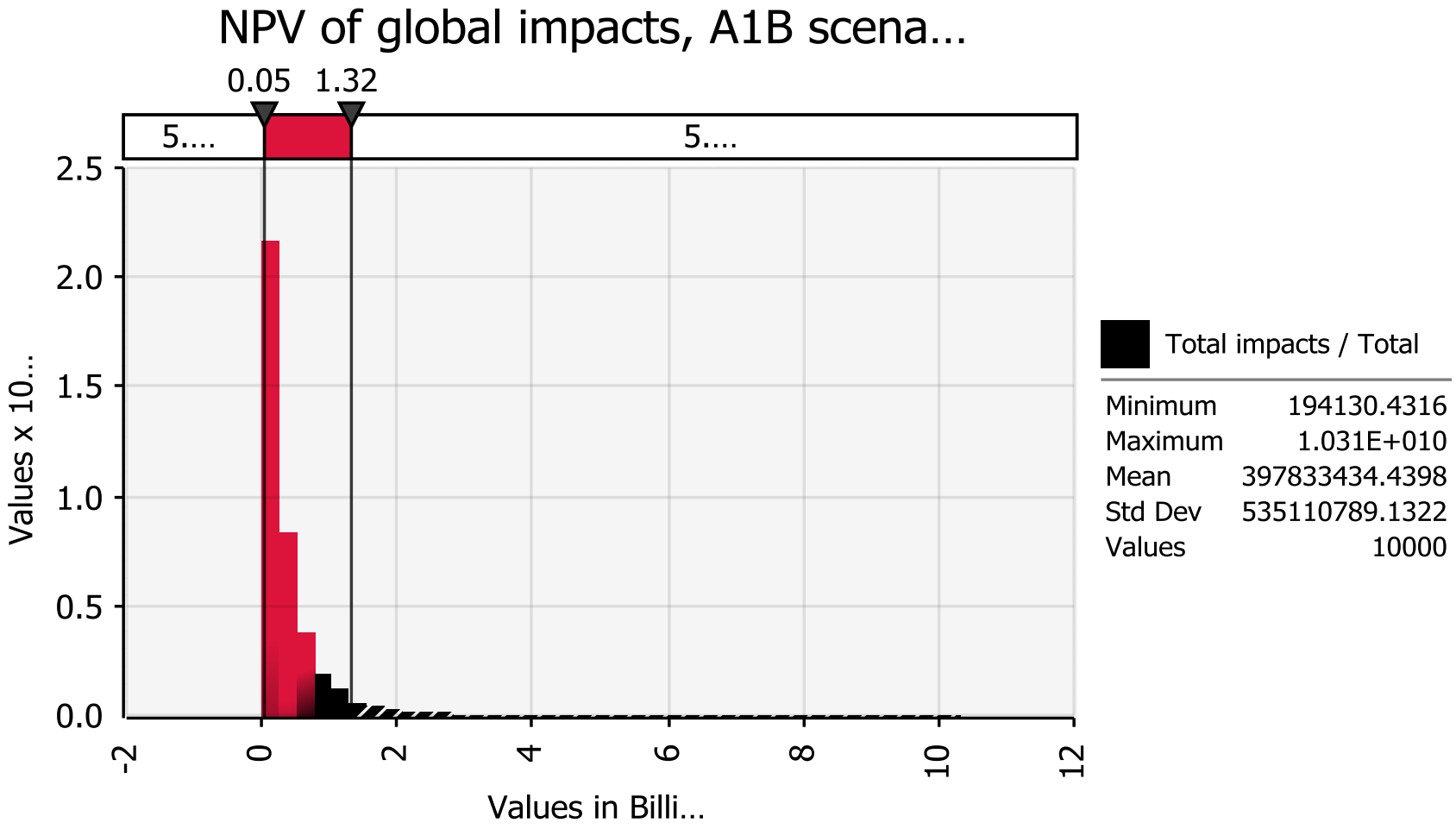



Source: 10000 PAGE09 runs

SEI

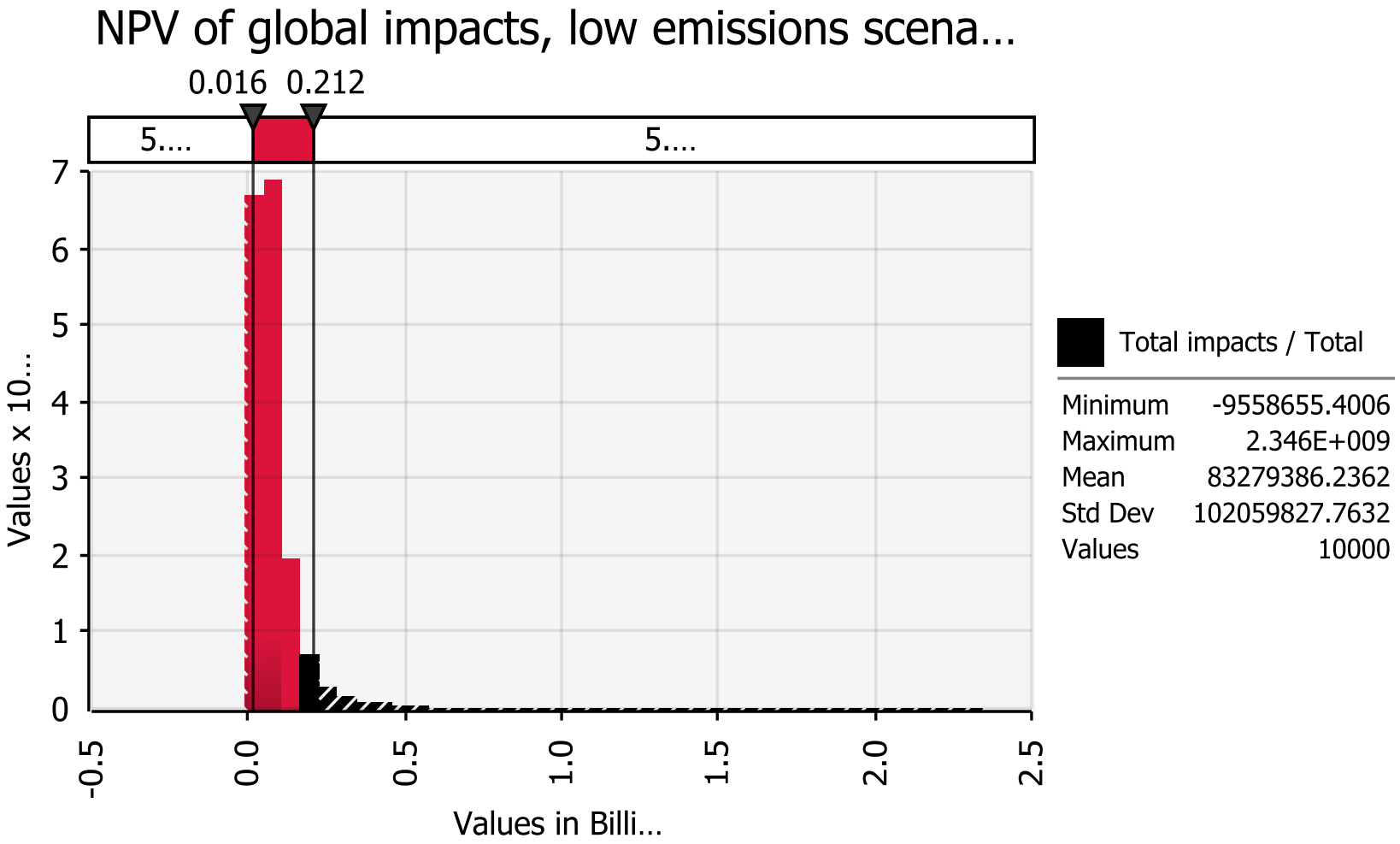
ClimateCost

CAMBRIDGE Judge Business School




Source: 10000 PAGE09 runs; A1B scenario

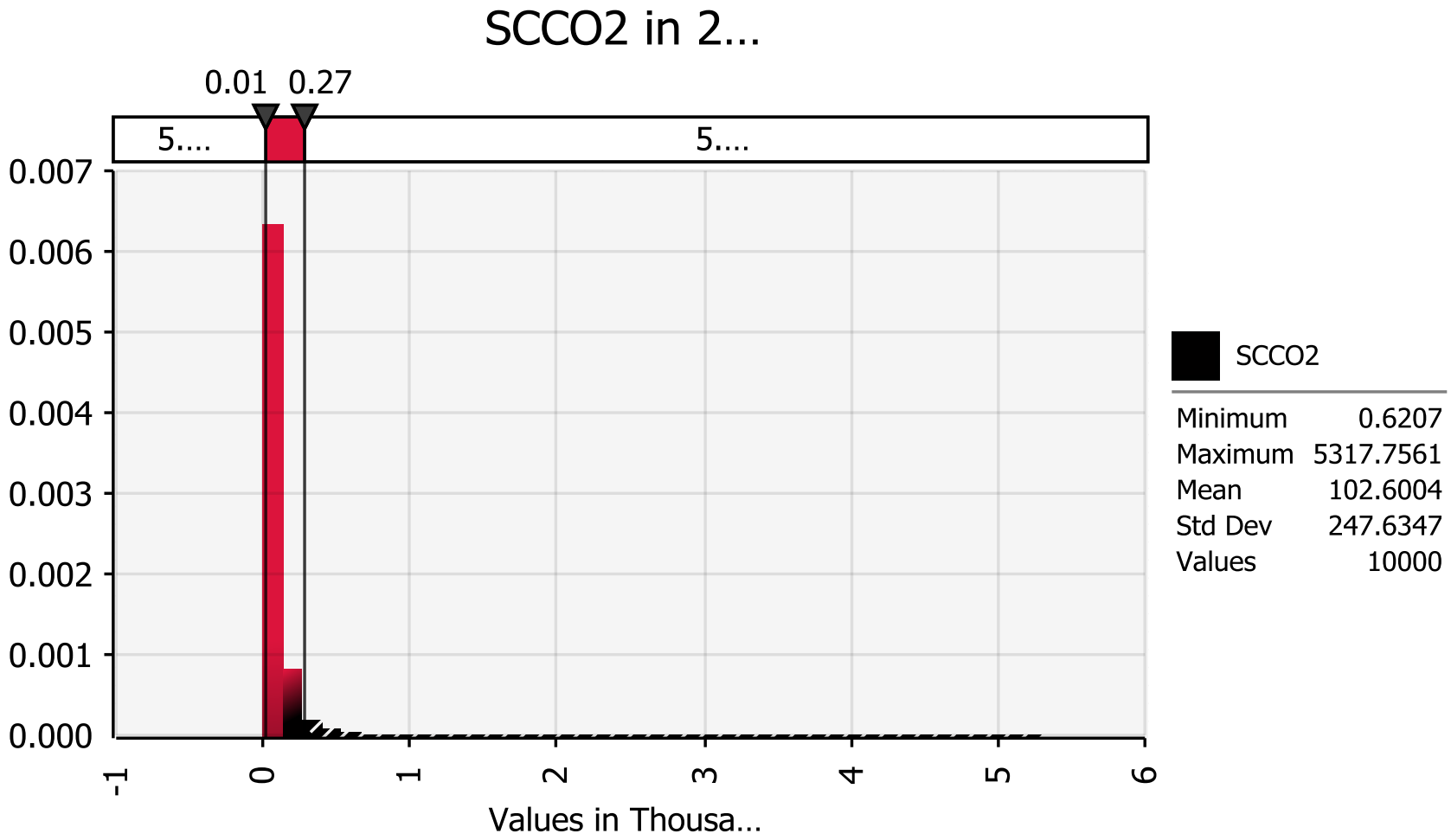
SEI ClimateCost CAMBRIDGE Judge Business School




Source: 10000 PAGE09 runs; 2016 r5 low scenario

SEI ClimateCost CAMBRIDGE Judge Business School

# Social cost of CO2, A1B scenario




Source: 10000 PAGE09 runs; A1B scenario

SEI ClimateCost CAMBRIDGE Judge Business School

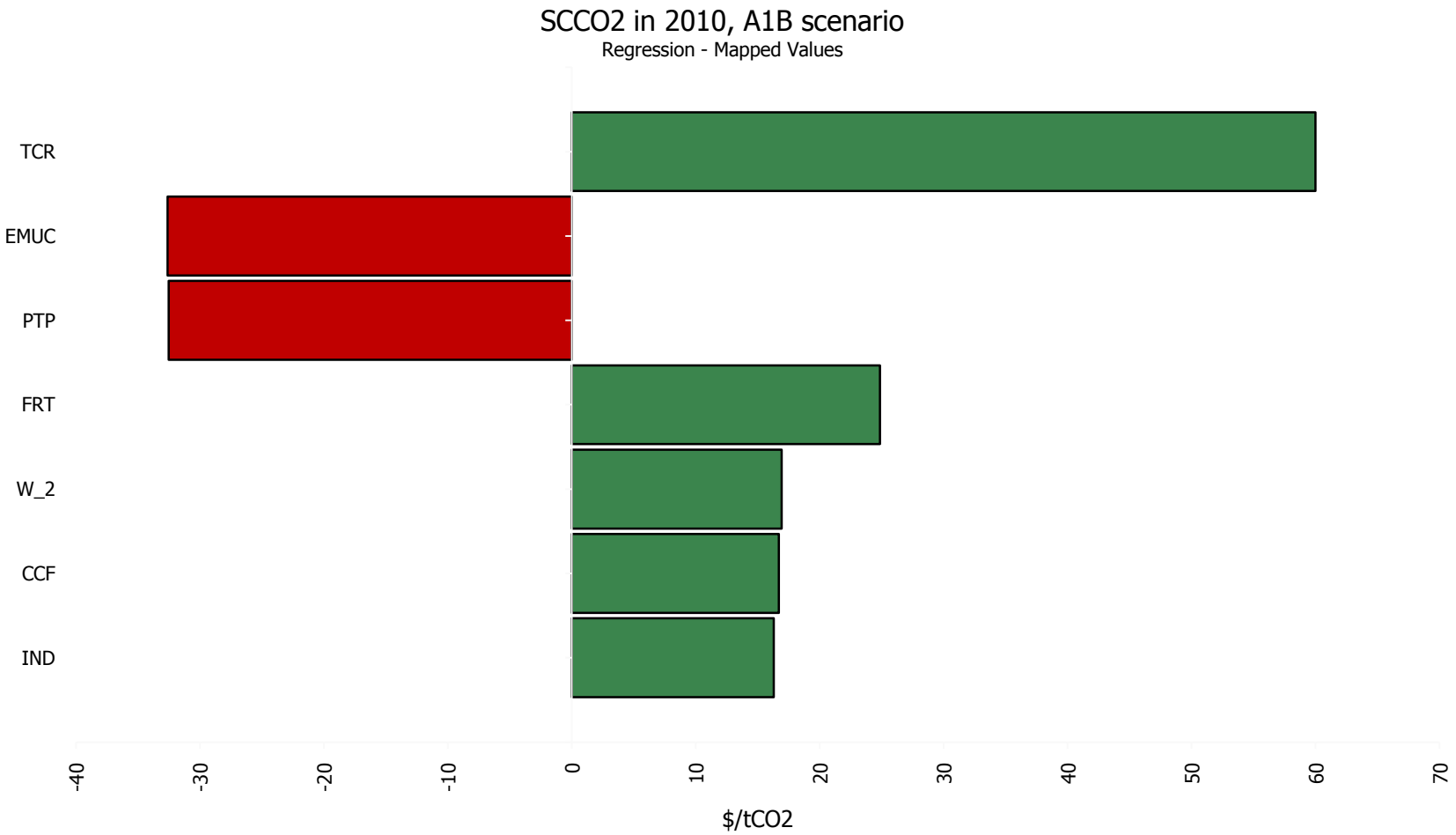
# The social cost of $CO_2$ in 2010

| *2010 - 2200* | *$US (2005) per tonne* | | |
|---|---|---|---|
| | **5%** | **mean** | **95%** |
| **A1B Scenario** | 10 | 100 | 270 |
| **Low emissions** | 10 | 45 | 120 |

*Source: 10000 PAGE09 model runs*

SEI ClimateCost CAMBRIDGE Judge Business School

# Major influences on the SCCO2




Source: 10000 PAGE09 runs; A1B scenario

SEI

ClimateCost

CAMBRIDGE
Judge Business School

# Comparison with results from PAGE2002

# SCCO2 in PAGE09 and PAGE2002

| *2010 - 2200* | *$US per tonne CO2* | | |
|---|---|---|---|
| | **5%** | **mean** | **95%** |
| **PAGE09** | 10 | 100 | 270 |
| **PAGE2002** | 3 | 28 | 85 |

*Source: 10000 PAGE09 and PAGE2002 model runs; A1B scenario*

SEI ClimateCost CAMBRIDGE Judge Business School

# Why is the SCCO2 so much greater in PAGE09?

- Normalised to EU base year GDP/capita.
- Less effective adaptation.
- Higher chance of a discontinuity.
- Proper accounting for very large impacts.
- $2005 not $2000.

# Supporting documents

**The PAGE09 model: A technical description**

Describes the changes to the science, impacts, abatement costs and adaptation. Appendices with all the equations and default inputs.

**The Social Cost of CO2 from the PAGE09 model**

Default inputs and first impact results from the model

**PAGE09 v1.7 user guide**

Contains brief instructions on using the model

SEI ClimateCost CAMBRIDGE Judge Business School